

Perseids, with the usual result of latter-day meteor watching—we saw none. However, it was a novel and exceedingly pleasant experience to be there lying under the stars, the greatest telescope on earth immediately to one's side, the highest building in the world towering over our heads.

It is to be hoped that after the Exhibition is over the telescope will find a resting-place under the Home Government at some station out of the city, where the purity of the atmosphere will allow of its power being efficiently used.

C. P. BUTLER.

TOBACCO.

WHEN Columbus landed in 1492 in the West Indies he found the natives smoking a herb wrapped in a maize leaf, and the name of the herb was Tobago. In 1560 Jean Nicot distributed plants raised from seed to various parts of Europe. These two events give us the clue to the popular and scientific names of a drug the cultivation and preparation of which have now attained such enormous importance that Governments are supported by the revenue derived from its taxation, and colossal fortunes are made by its sale. Some idea of the scale on which the industry is carried on may be gathered from the statistics recently published in the "Year-book of the United States Department of Agriculture for 1899," where we read that during that year 266,661,752 pounds of tobacco, 4,542,016,570 cigars and 4,590,388,430 cigarettes were prepared in the United States alone, yielding a revenue to the Government of 52,043,859.05 dollars.

Small wonder then that the cultivators of so valuable a plant have shown great interest in all the processes of raising, planting, manuring and gathering the crop, and of drying, curing and preparing it for market; or that consternation has arisen in their midst at the origin and spread of a disease which attacks the golden leaf, and bids fair to ruin the crop in some districts. It happens, moreover, that biological problems of wide significance are arising in connection with the complex art of fermenting the leaf so as to obtain the best flavour and strength, as well as in regard to the "Mosaic disease" above referred to, and the experience of Dutch growers, of which an excellent account is now to hand in Koning's "Der Tabak, Studien ueber seine Kultur und Biologie" (Amsterdam and Leipzig: W. Engelmann, 1900), shows that the employment of scientifically trained botanists in the technical laboratories of tobacco plantations is likely to be as usual an event in the future as in breweries and bacteriological laboratories.

The tobacco plant is exceedingly small in the seedling stage—eighteen thimblefuls of seed suffice for a hectare, *i.e.* two and a half acres of land—and is very carefully raised in pots and manured with pigeon's dung, planted out and weeded with extraordinary precautions against numerous enemies, and the leaves eventually picked by hand, sorted, tied into bundles and hung to dry. It is a very exhausting crop, and requires much potash; and an astonishing amount of information has accumulated concerning the effects of different soils, manures, climate and other factors of the environment on the properties of the leaves. Moreover, there are numerous cultivated races in existence in the various tobacco-growing countries, as always occurs with planted crops.

During the process of slow drying the leaf may remain alive for two to three weeks, and the contained starch is converted into sugar, and further alterations result in an increase of acids. Proteids diminish and amines increase, but the nitrates and alkaloids (nicotin) should undergo no change. The slow alterations referred to are essential, and due to enzyme and other actions in the still living leaf; in artificially or rapidly dried leaves

the arrest of such changes materially affect the flavour and burning of the tobacco, and naturally much turns on the age and quality of the leaf itself, the soil and season and other conditions of growth, &c.

The dried or "cured" leaves are next submitted to fermentation, a process of vital importance in the opinion of the tobacco expert, since it is this which determines the finer flavours and odours of the manufactured product. Fermentation is started by damping heaps of 15,000 to 30,000 lbs. of the dried leaves, packed in a special manner, and carefully watched by experienced workmen as the temperature rises. The process occupies three to four months, and the leaves are turned about once a month. The temperature rises to about 50–56° C., and a loss of vapour, accompanied by a sweet and sharp odour, is noticed. The reaction may be neutral, though in some cases ammonia is given off, due to the action of undesired bacteria.

As would be expected, the fermentation is always accompanied by bacteria; but it has long been in dispute whether the essentials of the process are due to bacteria or to the action of special enzymes in the cells of the leaves.

Suchsland's researches had convinced him, not only that the fermentation is due to bacteria, but that a peculiar species of bacteria was specially concerned in the production of the approved flavour, and that the desirable properties of Cuban tobaccos could be imparted to inferior growths by introducing this species into the fermentation. Loew, on the other hand, maintained that the aroma and flavour depend simply on the action of enzymes or other cell-contents in the leaf itself.

Koning has investigated the various bacteria found in the fermenting heaps, and followed the changes induced in the tobacco.

Put generally, the fermented tobacco undergoes little or no change as regards the total nitrogen or the nicotin, but organic acids diminish, and the sugars and nitrates are destroyed, and various aromatic substances are formed which affect the quality of the product.

Among the bacteria isolated Koning claims to have found the species concerned in this remarkable neutral fermentation, and which imparts the aroma and flavour desired, and thus confirms Suchsland's results. He states that tobacco infected with the specific bacteria, fermented and made up, and then handed to experts, was selected by the latter as the superior from specimens containing other kinds. There is more than a touch of the dramatic in this scene of the experts sitting down to smoke a pair of cigars each, in packets of two, and labelled *a* and *b*, *c* and *d*, &c., only; but the evidence appears conclusive.

During the last ten years increased attention has been drawn to a disease of tobacco leaves, which causes irregularly alternating light and dark patches, and is known as the "Mosaic disease." Koning has established that this is infectious, and is carried through the fields by the fingers of the workmen who "top" the growing plants by pinching off the buds. He has examined the various fungi known to cause leaf-diseases in tobacco, and cannot refer it to these, and the presumption that it is a bacterial disease was strengthened by finding that certain manured soils were almost sure to have badly diseased plants on them; and that experiments showed that if a bit of diseased leaf, or a little of the sap from such is rubbed into a wound, the young leaves formed above the wound contract the disease. The same result follows if such sap is placed at the roots of healthy plants. But infection fails in all these cases if the sap is previously boiled.

Here may be mentioned that Adolf Mayer had proved the infectious nature of the filtered sap in 1885, and Beijerinck, working at this disease a short time ago (1898), had come to the conclusion that since no

organisms could be isolated from the sap—the infectious nature of which he also proved—which will reproduce the disease, and since the same sap filtered through porcelain still infects the plants, unless it was previously sterilised by heating, the causal agent must be a *contagium vivum fluidum*—a something of the nature of a poisonous enzyme, which not only diffuses through the plant-membranes—e.g. the cell-walls of root-hairs—but increases as it passes from cell to cell.

Koning confirms Beijerinck's principal results, but concludes that since the infecting fluid may be heated to 100° C. for a few minutes without losing its powers, whereas alcohol and glycerine destroy the virulence, as also does repeated filtration through porcelain, the active agent is an extremely minute organism, which can traverse the pores of a filter. He compares the results with those obtained with the virus of various animal diseases from which no organism has as yet been isolated.

It should be borne in mind that the existence of organisms small enough to pass through a porcelain filter has been accepted by several authorities.

When we reflect that well-studied micrococci are only 0.5–0.8 μ in diameter, and that the wave-length of those light rays corresponding to the sodium-line D is about 0.6 μ , some of these matters become less astounding: organisms 1/5th to 1/10th this size would probably be well beyond the powers of our best lenses, and would roll through the pores of a filter as shot through the meshes of a sieve.

It thus appears that—without regarding the work as quite conclusive, which it is not—we have here important contributions to several most weighty biological questions centred about the culture of an economic plant.

NOTES.

THE International Congress of Botany was opened in Paris on the 1st inst., and was in session until Tuesday last. M. Prillieux was the president.

THE new science laboratories at King's College, London, are to be opened on the 30th inst. by Lord Lister.

ANOTHER death from plague has occurred in Glasgow, bringing the number of fatal cases in hospital since the outbreak up to six. A fatal case of plague is also reported from Llandaff.

A REUTER telegram announces the arrival at Copenhagen, on October 4, of Lieut. Amdrup and all the members of his expedition. From July 18 to September 2 the expedition, while engaged on the coast of Greenland, explored and mapped out a stretch of land hitherto entirely unknown and extending from Cape Dalton, 69°28', to Aggas Island, 67°22'. Lieut. Amdrup is reported to have brought with him important collections, the results of his researches. The *Antarctic* reached Tasiusak on September 11, and sailed thence on her return journey on September 18.

THE *Athenaeum* states that the Kolthoff Arctic Expedition has succeeded in bringing to Sweden a male and a female calf of the musk ox (*Ovibos moschatus*, Gmelin). As soon as the animals appear to be acclimatised they are to be set free in the northern mountain regions, where it is thought they will speedily increase in number, as they are very prolific. Herr Kolthoff has great faith in the future importance of the musk ox, not so much as an article of food as on account of its thick brown wool, which is said to be remarkably strong.

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THE petrified remains of the extinct rhamphorhynchus have been discovered in the stone quarries of Eichstätt, Bavaria. It is stated that the teeth and fingers are very distinct, and that the membrane between the fingers is visible in places.

ACCORDING to the *Exchange Gazette* of St. Petersburg, the question of the official introduction of the metric system of weights and measures into Russia has been decided in principle in an affirmative sense. The Ministry of Finance is now considering in what manner, and when, the projected reform shall be carried out.

THE trustees of the American Medical Association have established a fund of 500 dollars, to be expended annually for the encouragement of scientific research; but no individual is to receive more than 100 dollars at one time.

THE lecture arrangements of the London Institution for the session terminating on February 28 next have now been completed. The science lectures are as follows:—"The Rise of Egyptian Civilisation," by Prof. Flinders Petrie; "The Earth's Beginning," by Sir Robert Ball; "The Earth's Earliest Inhabitants," by Prof. Grenville Cole; "The Caves of Jenolan," by Mr. F. Lambert; "The Tercentenary of the Science of Electricity," by Prof. Silvanus Thompson; "The Evolution of the Brain," by Dr. Alex. Hill; "Modern Aeronautics," by Mr. Eric S. Bruce; "The First Ascent of Mount Kenya," by Mr. H. J. MacKinder; "The Effect of Alcohol on the Nervous System," by Prof. Victor Horsley; "The Decorative Art of Primitive Peoples," by Prof. A. C. Haddon; and "Aquatic Autocrats and Fairies," by Mr. F. Enock. The Christmas course, intended for juveniles, is to be delivered by Prof. W. B. Bottomley, and will be devoted to "Structure and Colour," "Insect Visitors," "Unbidden Guests," and "Place in Nature."

THE next meeting of the Royal Microscopical Society will be held on Wednesday, the 17th inst., when Part ix. of a report on the recent Foraminifera of the Malay Archipelago will be presented. Preceding the meeting there will be an exhibition of slides and models of skin structure, by Mr. F. W. Watson Baker.

THE first monthly general meeting of the new session of the Institution of Mechanical Engineers will take place on Friday, October 19, when a paper, entitled "Observations on an Improved Glass Revealer for Studying Condensation in Steam Engine Cylinders and rendering the Effects Visible," will be read by Mr. Bryan Donkin, and discussed.

A new monthly meteorological journal has recently made its appearance in Holland, and bears the name of *Nederlandsch Tijdschrift voor Meteorologie*. The style of the journal is popular in character.

THE current *Geographical Journal* publishes further details as to the programme of Dr. Sven Hedin's journeys in Northern Tibet and neighbouring regions for the present year. At the time of sending his last letter, on June 27 last, the explorer was about to start for the Chamen Tagh, whither his caravan had already preceded him, his intention being to cross the Astyn Tagh and Koto-Shili ranges, so as to obtain a geological section of the country, and correct his route with that of his former Tibetan journey. After returning to his headquarters in the Chamen Tagh, he hoped to make his way across Northern Tsaidam to Sachu, and thence west to the old bed of Lob Nor, continuing his investigations of the latter end of the ruins in its vicinity. Thence he proposed to carry a chain of altimetric observations to Kara-koshun and Chaklik. He hoped to arrive at the last named point by about January 1, 1901.